



Original Article

Comparison of the effects of volemic reposition with 7.5% NaCl or blood in an experimental model of muscular compression and hemorrhagic shock[☆]

Q1 Mauricio Wanderley Moral Sgarbi*, Bomfim Alves Silva Júnior, Daniel de Almeida Pires, Irineu Tadeu Velasco

Universidade de São Paulo, Santa Casa de Santos, Santos, SP, Brazil

ARTICLE INFO

Article history:

Received 2 May 2017

Accepted 8 June 2017

Available online xxx

Keywords:

Crush syndrome

Hemorrhagic shock

Rabbits

Hypertonic saline solution

ABSTRACT

Objective: Crush syndrome is characterized by traumatic muscular injuries with severe systemic clinical repercussions. The systemic inflammatory reaction characterized acutely by infiltration of neutrophils in the lungs has been studied as part of the spectrum of crush syndrome. Experimental research may demonstrate alternative treatments for crush syndrome. The authors studied the hypothesis that hypertonic saline solution (7.5% NaCl) could minimize the local and systemic effects in a model of muscular compression and hemorrhagic shock.

Methods: Rabbits were submitted to a new model of muscle compression associated with hemorrhagic shock. Compression was applied through an Esmarch bandage, used for 1 h on the entire right lower limb. Hemorrhagic shock was induced for 1 h by dissection and catheterization of the carotid artery. Blood replacement or hypertonic saline solution was used to treat the shock. Biochemical analysis of plasma, quantification of muscular edema, and infiltration of inflammatory cells in the lungs were carried out.

Results: Animals treated with hypertonic solution presented the same hemodynamic response as the blood treated patients, less water in the compressed muscles and less infiltration of inflammatory cells in the lungs. The blood group presented hypocalcemia, a facet of crush syndrome.

Conclusions: The proposed model was effective for the study of crush syndrome associated with hemorrhagic shock. The treatment with hypertonic solution showed benefits when compared with blood volume replacement.

© 2017 Sociedade Brasileira de Ortopedia e Traumatologia. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

[☆] Study conducted at Laboratório de Emergências Clínicas (LIM 51), Universidade de São Paulo, Santos, SP, Brazil.

* Corresponding author.

E-mail: moralsgarbi@yahoo.com.br (M.W. Sgarbi).

<https://doi.org/10.1016/j.rboe.2018.07.006>

2255-4971/© 2017 Sociedade Brasileira de Ortopedia e Traumatologia. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Comparação dos efeitos da reposição volêmica com NaCl 7,5% ou sangue em um modelo experimental de compressão muscular e choque hemorrágico

R E S U M O

Palavras-chave:

Síndrome de esmagamento
Choque hemorrágico
Coelho
Solução salina hipertônica

Objetivo: A síndrome de esmagamento é caracterizada por lesões musculares traumáticas com graves repercussões clínicas sistêmicas. A reação inflamatória sistêmica, caracterizada agudamente por infiltração de neutrófilos nos pulmões, tem sido estudada como parte do espectro da síndrome de esmagamento. A pesquisa experimental pode demonstrar opções de tratamento para a síndrome de esmagamento. Os autores estudaram a hipótese de que solução salina hipertônica (NaCl 7,5%) pudesse minimizar os efeitos locais e sistêmicos da síndrome de esmagamento em um modelo de compressão muscular e choque hemorrágico. **Métodos:** Coelhos foram submetidos a um novo modelo de compressão muscular associado ao choque hemorrágico. A compressão foi feita por uma faixa de Esmarch aplicada por uma hora em todo membro inferior direito. O choque hemorrágico foi induzido durante uma hora por dissecação e cateterização da artéria carótida. O choque foi tratado com reposição de sangue ou solução salina hipertônica. Foram feitas análises bioquímicas do plasma, quantificação do edema muscular e infiltração de células inflamatórias nos pulmões. **Resultados:** Os animais tratados com solução hipertônica apresentaram a mesma resposta hemodinâmica observada naqueles tratados com sangue, menor quantidade de água nos músculos comprimidos e menor infiltração de células inflamatórias nos pulmões. O grupo tratado com sangue apresentou hipocalcemia, característica da síndrome de esmagamento. **Conclusões:** O modelo proposto mostrou-se efetivo para o estudo da síndrome de esmagamento associada ao choque hemorrágico. O tratamento com solução hipertônica apresentou benefícios quando comparado com a reposição volêmica com sangue.

© 2017 Sociedade Brasileira de Ortopedia e Traumatologia. Publicado por Elsevier Editora Ltda. Este é um artigo Open Access sob a licença de CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Traumatic muscle compression is part of the spectrum of a syndrome with important clinical repercussions: crush syndrome (CS).¹ CS was described in World War II when the clinical evolution of patients rescued from debris and the sequence of systemic alterations that accompanied lower limb crush syndrome were observed.² In the year following the publication of these results, those authors developed an experimental model to study the pathophysiology of the disease.³

Injury to muscle cells massively releases ions into the intra or extracellular environment, releases proteins (especially myoglobin) into the circulation, and is associated with extracellular fluid retention (edema). All these factors can cause heart and renal alterations, as well as hypovolemic shock.¹

In addition to the known myoglobinuria, which evolves to renal failure, in experimental models, CS also appears to be associated with a systemic inflammatory response mediated by neutrophils and cytokines, the main shock organ being the lungs.⁴⁻⁸

In accident victims, the interaction of external agents acting on the body can lead to multi-system injury and acute hemorrhage. Volume replacement with isotonic crystalloid solutions (used in an infusion equivalent to three times the estimated hemorrhage volume) is recommended in treatment protocols.⁹ Hypertonic saline solution (NaCl 7.5%)

has been studied in experimental laboratory studies and in clinical protocols as an alternative in the treatment of hypovolemic shock.^{10,11} Hypertonic solution has an important anti-inflammatory effect that could be related to the improvement in the survival of the animals that received this infusion in experimental protocol.^{10,12}

Among all aspects of muscle compression injury, the present study focused on muscle edema, plasma electrolyte alterations, and neutrophil infiltration in the lungs (which may be associated with a distant inflammatory reaction). The authors hypothesized that large muscular lesions can course with an inflammatory reaction in the lungs, thus contributing to the onset of CS and that hypertonic saline solution can reduce the edema of the crushed limb and may reduce the pulmonary inflammatory reaction.

Methods

Surgical procedures

The experimental protocols were approved by the Research Ethics Committee. The animals were provided by the Vivarium Center and kept for at least three days in the vivarium for observation and adjustment to the new environment.

In this study, 24 male New Zealand rabbits weighing between 2500 and 3000 g were used. Surgical procedures were done under aseptic conditions.

Download English Version:

<https://daneshyari.com/en/article/10211655>

Download Persian Version:

<https://daneshyari.com/article/10211655>

[Daneshyari.com](https://daneshyari.com)